CONSTRUCTION AND VALIDATION OF SKILL TEST FOR SQUASH PLAYERS

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ABSTRACT

The present research focuses on the construction and validation of a standardized skill test battery specifically designed for evaluating the fundamental playing abilities of squash players. Despite squash being a widely recognized and competitive racket sport played at national and international levels—including its upcoming inclusion in the 2028 Olympic Games—there remains a lack of validated, objective tools to assess player performance. This study aims to bridge that gap by identifying key skill components of squash through expert consultation and literature review, and by developing a reliable test battery for use by coaches, educators, and selectors.

A purposive sample of 100 male squash players, aged 17 to 21 years and possessing at least three years of playing experience at recognized competitive levels, will be drawn from universities, colleges, and academies across India. The research will focus on assessing key fundamental skills: parallel drive (forehand and backhand), cross-court drive, service (both sides), volleying, and court movements (front, mid, and backcourt). Data reliability will be ensured through test-retest procedures, and statistical tools such as Pearson's product-moment correlation will be used to determine reliability. Norms will be developed using percentile ranks and Six Sigma methodology. The results are expected to provide an objective and scientific framework for evaluating and enhancing squash performance, thereby supporting training, talent identification, and team selection processes at various competitive levels.

Key words: Squash, Skill Assessment, Performance Evaluation, Standardized Testing, Talent Identification, Training Methodologies.

TABLE OF CONTENTS

1. **CHAPTER -1** PAGE NO.

INTRODUTION **01**

a) Brief introduction of the topic 01
b) Objectives of the study 05
c) Statement of the problem 05
d) Delimitation 06
e) Limitations 06
f) Definition and explanation of terms 07
g) Significance of the study 09

2. CHAPTER -2

REVIEW OF RELATED LITERATURE **10**

3. **CHAPTER -3**

METHODOLOGY **24**

a) Selection of subjects 24
b) Selection of Variables 24
c) Reliability of the test 25
d) Procedure for collection of data 26
e) Statistical technique 26

4. REFERENCES **27**

CHAPTER-II

INTRODUCTION

Squash, sometimes referred to as squash rackets, is a dynamic sport that is played on a four-walled court in singles and doubles divisions. Winning scores are calculated using a system of eleven points. Like other racket sports, the game is often played between two people but can also include four. Aiming to outsmart their opponent, players take turns striking the ball inside the court. The International Olympic Committee (IOC) acknowledges the World Squash Federation (WSF), the governing organization of the sport. Though many have applied, squash will debut in the 2028 Games, a milestone eagerly awaited by its fans.

Squash has several unique qualities:

1. It is a semi-contact game.
1. Singles, doubles, and mixed doubles formats allow for play.
2. Venues could be indoor or outdoor (glass courts).
3. Though it has not yet appeared in the Olympics, squash is included in the Asian Games, Commonwealth Games, and other world-level competitions.

While in India the Squash Racket Federation of India (SRFI) manages its promotion and growth, the WSF is the main worldwide governing body for the sport. Introduced at Harrow School about 1830, squash fast acquired popularity in England. The fast-paced, strategic play of the game combines physical agility with mental sharpness, hence appealing to many.

From England to other areas of the world, squash has a rich past spread by British military influence. Countries such as Australia have fully embraced the game, creating formal squash federations and developing elite players. Founded in 1967, the International Squash Rackets Federation currently known as the World Squash Federation, grew its influence and standardized the sport all over.

Largely pushed by British military men, squash in India acquired popularity before World War II. Based in Chennai, the SRFI oversees more than 20 state associations and divisions all committed to promoting the sport nationwide. Driving squash's

expansion and success in India depends on major cities like Mumbai, Delhi, Kolkata, and Chennai.

The Need for Uniform Skill Testing

Skill tests in sports are used to gauge the basic abilities needed to play a particular sport. Given the broad spectrum of abilities in most sports, choosing the most vital ones is required. Usually, this choice is based on statistical methods, expert opinions, and published research. A test battery is the whole set of skill items. Offering a motivation for development, skill tests enable pupils to assess their performance in basic abilities. They help coaches and teachers track performance, assess their instructional strategies, and create training plans as well.

Though crucial, skill assessments in squash are not supported by consistent evaluation testing for ability, grading, and performance forecasting. Played on a four-walled court with a small, hollow rubber ball, squash is a racket sport played by two (singles) or four players (doubles). Players must alternate in hitting the ball with their racket onto the playable surfaces of the court walls. Formerly known as squash rackets, the game referred to the "squashable" soft ball used in play in contrast to the harder ball used in its sister game, rackets.

Squash Testing and Assessment

A test is a kind of asking and measurement that evaluates information retention and capacity or gauges ability in some physical endeavor. While measuring uses different instruments for data gathering, testing is a kind of measurement. While measurement could be structured both formally and informally, testing could be seen as being done formally. Teachers might utilize a test meant to enhance the learning process to rate and offer analysis to stakeholders on educational initiatives.

The true difficulty in the educational process is to apply testing as a guiding tool rather than only for the sake of testing so that the outcome data might be employed. The responsibility of producing well-rounded and physically educated children is carried out by means of measurement and evaluation. Used wisely, the assessment process can guide instruction in ways not possible by any other approach, so educating teachers not only about beneficial changes in children but also about societal consequences.

Though tests and measurements are crucial in training teachers of physical education and sports, the process of assessing students in physical education schools sometimes causes unhappiness because of perceived "fairness" concerns. Many question the choice of players at the school, club, state, and national levels for lacking foolproof standards. This underlines the need of more practical and scientifically proven ways of assessing players' skills since there is a disparity in the readiness of teachers, coaches, and selectors to use experimental techniques recommended in the literature on test and measurement.

In the teaching or coaching process, evaluation is absolutely essential. Evaluation helps educators to gauge the degree of student learning and comprehension. Therefore, educators have to be conscious of several objective assessment methods that help categorize pupils' development throughout time and fairly measure their abilities.

Performance and skill are naturally connected. Emphasis from the beginning is on practicing and mastering the basic abilities of a game. Skills can be generally classified as simple or sophisticated. While complicated talents are hard to judge objectively and are learned only after mastering simple skills, simple skills are easy to learn and judge objectively. There are both subjective and objective ways to assess skills; some are legitimate and consistent while others are not. Simple talents are easier to assess than complicated ones, and qualitative elements of skill performance are difficult to measure objectively.

Two ways to gauge playing ability are skill tests and player rankings. While ranking by standing in a round-robin tournament in actual game circumstances delivers a thorough and precise evaluation, skill testing by means of simulated test items offers an objective measure. The issue, meanwhile, is the practical one of getting qualified judges and guaranteeing consistency across various circumstances. Usually, judges' ratings or tournament standings serve as the basis for validating skill testing against reasonable standards. A solid sport skill test's essential characteristics include dependability, validity, simplicity of scoring, and accuracy.

The physical education courses are disorganized and the tests and assessments fall short of the level of other disciplines. To assess the results of physical education examinations properly, staff members must carefully design their testing programs. They will not be seen as important supplements to education without well-designed, carried out, and understood assessment processes.

The testing in physical education programs now clearly reflects the reality that a "man's reach exceeds his grasp." On the other hand, it offers a real difficulty as well. If we are to create a good educational basis, we must grasp the meaning of measurement.

Physical education assessment can be a mix of both objective and subjective. Classification, progress assessment, and marking are done using skill tests, which indicate a person's capacity to participate in a particular sport. These exams guarantee that the physical education assessment is thorough, correct, and supports the general student development.

Basic and Advanced Squash Skills

Every novice in squash should first learn basic and technical squash skills. Among many other tactics, players develop extra and advanced abilities such volleying, drops, boasts, drives, lobs, and cross-court shots as they age and improve their expertise. The next section offers a description of basic squash techniques and skills.

Ranging from novices to experts, the forehand drive is the most natural shot and is regarded as a fundamental, required component of squash skills and methods. The playing hand—forehand or backhand—side of the body executes this stroke. The backhand drive is the stroke played from the other side of your playing hand. While a left-handed player strikes the ball from the right side, a right-handed player strikes it from the left. At first, players find it difficult to use the backhand drive; nevertheless, with consistent effort and diligent practice, they may perfect this shot, which turns into a vital instrument among the many abilities and methods of squash.

In squash, the serve begins the point. The server is the one who serves; the opposite end player is the receiver. A few different kinds of serves are the drive serve, the power serve, and the lob serve. Executing the proper stance, the proper squash grip, and the appropriate ball toss will help one to have a good serve. If the server can do the appropriate body movements, such as knee bending and body coiling, the right racket swing, and the right point of contact, power can be added. Most significantly, the serve has to be improved as a main weapon with exact accuracy and depth.

Squash is a game of strategic play and fast motions. Players should be able to begin fast with an explosive first step. They have to respond to different kinds of projectiles and move quickly always changing course. Squash is a demanding physical sport that calls for quickness, endurance, agility, flexibility, and player adaptation to reach

their best. These are among the squash talents and methods required to be a successful player. Players must speed to reach the ball as fast as possible and dexterity to predict their opponent's stroke.

All players, from novice to expert, must learn basic and advanced abilities in squash just like they do in tennis. Players who master these skills by means of constant practice and assessment will be able to enhance their performance, hence increasing the competitiveness and enjoyment of the game. This study is to build and validate a talent test for squash players, so guaranteeing a consistent instrument for evaluating and improving their skills and so ensuring their readiness for competition, including the next inclusion of squash in the 2028 Olympics.

A standardized talent test for squash players will help to close current holes in player evaluation and development. Establishing a strong evaluation system will help to improve the training strategies, performance assessment, and general growth of squash players by means of this study. Reliable and valid skill assessments that can precisely measure and forecast players' performance are absolutely necessary as we approach the inclusion of squash in the 2028 Olympics, therefore guaranteeing their sufficient readiness to participate on the world stage. This study will be essential in reaching these goals and will help squash to develop and succeed both domestically and abroad.

STATEMENT OF THE PROBLEM

The purpose of this study is the construction and validation of a comprehensive skill test specifically designed for squash players.

OBJECTIVES OF THE STUDY

1. To provide criteria to teachers and coaches on how to measure and evaluate students’ performance in squash.
2. To impart knowledge on skill tests that measure the playing ability of squash players.
3. To construct a skill-related fitness test specifically for squash players.

4. To establish percentile norms for the fundamental skill test for squash players.

DELIMITATIONS

1. The study will be delimited to one hundred (100) male squash players from different college / University/Academies.
2. The study will be restricted to age ranges from 17 to 21 years.
3. The study will be delimited to players who are currently participating in State/ National/College/University level & all other competitions organized by (SRFI) Squash Rackets Federation of India.
4. The study will be confined to the players with a minimum of three (03) years of Squash playing experience.
5. The study will be delimited to the following fundamental skills-
   - Parallel drive from the backcourt (forehand and backhand both)
   - Service from both the side
   - Cross court drive (forehand and backhand both)
   - Volleying
   - Court movements
6. The study will be delimited to the front court movements, mid court movements and backcourt movements.

LIMITATIONS

1. Factors such as players' habits, lifestyle, daily routine, diet, and climatic conditions will not be considered in this study.

2. No motivational or psychological interventions will be used during the procedure; any variations in performance due to a lack of motivation will be recorded as constraints of the study.
3. Variations in performance due to player fatigue will be recognized as potential factors that might affect the results.
4. The quality of the squash racket will be considered a constraint that could influence the test outcomes.

DEFINITION AND EXPLANATION OF THE TERMS

SKILL

According to Howland, J.L., "A skill is the ability to carry out a task with predetermined results often within a given amount of time, energy, or both".

Skill is defined as the "automatization of motor procedures".

Skill refers to the ability to choose and perform the right techniques at the right

Time, regularly, and with a minimum of effort.

TEST

A test is defined as "An instrument to measure a specific thing".

According to Barrow and McGee, "Test means a specific tool of measurement for the collection of data and obtaining responses from the person being measured".

EVALUATION

According to Hopkins and Stanley, “Evaluation can be either subjective or objective. It is the judgment of what the numerical measurement data actually mean”.

NORMS

According to Lipinski, M.K & Rimal, R.N, “Norms are regarded to exist as collective representations of acceptable group conduct as well as individual perceptions of particular group conduct”. “An experimental measure was developed so that educators may assess how well their pupils are doing in comparison to similar groups. Norms are frequently thought to be repeated in a sizable community.”

DRIVE

The drive in squash is a fundamental shot played with the intention of hitting the front wall returns parallel and close to the side walls to a good length; that is when the ball dies on its second bounce near the back wall.

SERVICE

The service, or serve, is the starting shot of a rally in squash. It involves hitting the ball from the service box to the front wall, aiming to make the ball land in the opposite back quarter of the court. A good serve puts the opponent under pressure and sets the tone for the rally.

VOLLEY

A volley in squash refers to hitting the ball before it bounces on the court floor. This technique is used to intercept and return the ball quickly, often catching the opponent off guard and maintaining an offensive position.

COURT MOVEMENTS

Court movements encompass the various ways in which a player navigates the squash court, including footwork, positioning, and agility. Efficient court movement is essential for reaching the ball quickly and maintaining balance and readiness for the next shot.

SIGNIFICANCE OF THE STUDY

1. The newly developed skill test battery will help physical educators and coaches to evaluate the performance of squash players effectively.
2. The norms developed in this study will assist players and coaches in assessing skill levels and making comparisons with other players.
3. The study will help in identifying potential talent in squash players, allowing for targeted development and training.
4. It will provide coaches with realistic and objective information about the standard of players, aiding in the accurate assessment of abilities.
5. The study will help coaches in selecting novice squash players by considering their physical and skill talents.
6. The results of the study will be beneficial for designing training schedules tailored to the different capacities of squash players.

7. The findings will assist in preparing comprehensive training schedules that align with the player's varying levels of skill and physical capacity.

CHAPTER-II

REVIEWS OF RELATED LITERATURE

The study conducted by **Gouttebarge et al. (2013)** aimed to develop a squash-specific exercise test (SSET) tailored to the physical and energetic demands of elite squash players and to evaluate its face and convergent validity. The SSET was designed through a systematic procedure, incorporating movement patterns typical in squash, with 4-6 stages of 5-10 runs over 39.72 meters, increasing speed at each stage and including brief rest intervals. To assess the test's validity, a cross-sectional study involving six healthy female elite squash players was performed. Face validity was determined by correlating the SSET outcomes with participant rankings from the Women's International Squash Players Association (WISPA), resulting in a Pearson correlation coefficient of -0.78 ($p > .05$). Convergent validity was evaluated by comparing the SSET results with a maximal treadmill running test, showing strong correlations for VO2max (0.90, $p < .05$) and HRmax (0.99, $p < .01$), but a weak correlation for lactate levels (-0.09, $p > .05$). In conclusion, the study successfully developed a squash-specific exercise test that demonstrated good face validity with WISPA rankings and strong convergent validity with respect to VO2max and HRmax, while the correlation for lactate levels was found to be poor.

This research, carried out by **Carl James et al. (2019),** sought to assess the validity and reliability of a fitness test tailored specifically for squash. The test aims to provide performance metrics along with important physiological indicators, such as V̇O2max, lactate turnpoint, and oxygen cost, relevant to the sport. Eight national squash players underwent three assessments: an incremental laboratory treadmill test (LAB) and two on-court fitness evaluations (ST) that consisted of repeated shuttle runs at progressively increasing speeds. The results revealed that the V̇O2max obtained from the ST was similar to that from the LAB, exhibiting a typical error of 3.3 mL.kg-1.min-1 and a correlation coefficient of 0.79. There were no significant differences in maximum heart rate, post-exercise blood lactate levels, or perceived exertion between the two methods. The ST showed high reliability, with consistent lap times across trials (mean bias of 1 lap, typical error of 3 laps, r=0.97). Moreover, physiological measures, including V̇O2max and lactate thresholds, demonstrated strong reliability. The study concluded that the ST is a valuable instrument for tracking training progress and tailoring individual training programs for elite squash athletes.

Begum, K. Shahnaz (2019) conducted a study, the purpose of this study was to construct a new skill test battery and to develop standard norms for Squash players. Initially 6 tests were designed on fundamental skills. A pilot study was conducted on 40 male Squash players from various clubs age ranged from 17 to 20 years. After extensive critical analysis 4 skill tests were finalized. Validity, reliability and objectivity were established on all selected test items. To arrive the final test battery 100 male Squash players were randomly selected from the LNIPE, Gwalior, Noida Stadium, Noida, Mayohall Sports Complex, Allahabad and their age ranged between 17 and 20 years with the mean age of 18.8, ± 1.9 years. The data, which was collected by administering the 4 skill test items i.e. Alternate Parallel Drive from Front Court, Parallel Drive from Back Court (Forehand and Backhand), and Court Run was statistically treated to develop norms for all the test items. The normative scales, namely, the Percentile Scale and 6-Sigma Scale were constructed for the male Squash players. The scores were further classified into five grades i.e. A, B, C, D and E or Excellent, Good, Average, Satisfactory and Poor respectively under normal distribution.

Yadav, Rahul (2024) conducted a study, the study aimed to create a comprehensive skill-related fitness assessment specifically for tennis players. Recognizing the inadequacy of generic fitness tests for sport-specific training, the researchers designed a test that incorporated core tennis skills—forehand drive, backhand drive, volley, and service—alongside fitness components such as forward, backward, diagonal, and side runs. A total of 200 tennis players were recruited. The assessment's reliability and validity were confirmed through extensive consultations with tennis coaches, educationists, and physical education experts. Four variations of the fitness test were developed and evaluated: TSRFT-V1, TSRFT-V2, TSRFT-V3, and TSRFT-V4. Each test included skill-based items selected for high face value, logical validity, and construct validity.

Descriptive statistics revealed the performance status of each variation. The Product Moment method was employed to correlate each test with playing ability performance. The TSRFT-V3 emerged as the most significant, showing a high correlation with actual tennis playing ability. Construct validity was further

confirmed by testing subjects at school, university, and national levels, demonstrating significant performance differences.

The TSRFT-V3 test showed high reliability (r = 0.893) and objectivity (r = 0.918). Grading criteria based on the Six Sigma scale were developed, categorizing performance into excellent, good, average, satisfactory, and poor. These criteria provided a robust and straightforward assessment of a tennis player's fitness status.

In conclusion, the TSRFT-V3 Skill-Related Fitness Test Course is a reliable, valid, and practical tool for assessing the fitness and skill levels of tennis players, aiding in talent identification and performance enhancement.

Ali Khan Mansoor (2016) conducted the study, this study aimed to construct a reliable, valid, and objective tennis skill test for junior national players in India. The research involved 100 U-18 ranked players with an AITA ranking below 200, using purposive sampling. Data collection occurred during various talent and championship series in Delhi, Gurgaon, Dehradun, Ambala, Karnal, and Indore. The primary criterion measure was the players' national rankings, with data collected on forehand drive, backhand drive, and service. Reliability, objectivity, and validity were assessed through correlation techniques, including test-retest method, expert evaluation, and player rankings. Norms were established using the six sigma scale, and qualitative grading was based on the normal distribution of scores. The tests' reliability was further validated through significant correlations with player rankings: forehand drive (-.912), backhand drive (-.898), and service (-.904). Norms for the skills were developed using the six sigma scale, categorizing performance into qualitative grades: Excellent, Very Good, Good, Average, and Poor.

In conclusion, the study identified the best tests for each skill based on reliability, objectivity, and validity. The constructed tests demonstrated significant relationships with test-retest scores, expert evaluations, and player rankings. These tests effectively measure the power and accuracy of junior tennis players. Norms and qualitative grading facilitate easy categorization of player performance. The developed skill tests have the potential to aid in talent identification and skill

assessment in junior tennis players, thereby contributing to their overall development and performance enhancement.

Khan and Kumar (2018) wanted to construct a specific skill test for tennis players of junior national level, for this the researched used three test batteries: forehand drive, backhand drive, and service. In this study, we used 100 tennis players who come under 200 AITA rankings as subjects, and we developed norms for the tests as well. Researcher used purposive sampling in this study and gathered data from various talent series and championship series. Results show that tests have a significant relationship with the national rankings of players.

Pandey, Naveen Kumar (2022) conducted a study, the aim of this is to construct skill test items for volleyball, focusing on serving, attacking, setting, blocking, and defensive abilities. Thirty male volleyball players aged 18 to 22 from Veer Bahadur Singh Sports College, Gorakhpur, who played at least at the state or national level, were selected as subjects. Data collection included five tests for each volleyball skill, and ten experts provided guidance during the pilot study. The serving ability test involved subjects using a tennis serve technique and scoring points based on where the ball landed in designated zones. The attacking ability test required subjects to spike the ball from position 4 or 2, with points awarded based on where the ball landed. The setting ability test involved passing a ball through a target ring, with points awarded for accuracy. The blocking ability test evaluated the subjects' ability to block effectively, with points based on the success of the block. The defensive ability (dig) test involved digging spiked balls and scoring points based on where the ball landed. The reliability, objectivity, and validity of each test were assessed using intra-class correlation. The results showed that the serving, setting, attacking, and blocking tests were reliable, objective, and valid. However, the dig test was valid but had poor reliability and objectivity, suggesting it could measure individual performance but might not consistently provide accurate results.

The study concluded that the constructed tests for serving, attacking, setting, blocking, and defensive abilities could effectively measure volleyball skills. Norms for each test were developed using percentiles, with scores categorized as Excellent, Very Good, Good, Average, and Poor. These norms provide a robust framework for

evaluating the physical and performance capabilities of volleyball players, facilitating objective assessment and selection for better performance in competitions.

Arun Prasath B (2013) conducted a study**,** this study aimed to design a skill test battery to measure fundamental volleyball skills at the intercollegiate level, structured in three phases: 1) Selection of Arbitrary Test Items, 2) Extracting the Most Appropriate Test Items and Developing the Final Test Battery, and 3) Constructing Norms for Final Test Battery Items. Initially, eleven test items were chosen with the help of field experts and literature review: accuracy in overhead pass, front and back pass, setting, reception, overhead service, overhead service (call and service), jump service, service, attacking, zone attacking, and quick ball attacking. Thirty volleyball players, aged 18-23 and participating in intercollegiate games, were randomly selected and tested on these items to establish their reliability using a rotated component matrix. In the second phase, the most appropriate test items were extracted: accuracy in passing, front and back pass, overhead service (call and service), zone attacking, and quick ball attacking. To validate these items, 120 intercollegiate volleyball players were selected and tested with standardized instruments. The overall playing ability of these players was used as a criterion measure for validation.

The study concluded that the identified test items—accuracy in passing, front and back pass, overhead service (call and service), zone attacking, and quick ball attacking—constitute a reliable Final Test Battery to evaluate the playing ability of intercollegiate volleyball players. Additionally, the percentile norms developed for this Final Test Battery were deemed highly appropriate for assessing and ranking players' skills effectively.

Sachin. G. M (2020) conducted a study,the purpose of this study was to construct volleyball skills and physical fitness tests and develop norms for volleyball players. To achieve this, 57 players from Karnataka who had represented at District, State, and National levels were selected. The subjects, aged 18-21, were from the Department of Youth Services and Sports (DYSS) Sports Hostel in Bangalore and a

National camp in Shivamogga. Purposive Random Sampling was used to select these subjects, and 428 additional players from various volleyball clubs in Bangalore and Shivamogga were tested to standardize the constructed tests.

The study focused on key volleyball skills: Serve, Pass, Attack, and Block, along with physical fitness variables such as Strength, Power, Flexibility, Agility, Coordination, and Speed. Data was analyzed using statistical techniques such as Mean, Standard Deviation, Coefficient of Correlation, and Factor Analysis to develop prediction equations for assessing volleyball performance.

Jagathesan R (2023) conducted a study,the study aimed to create a new skill test battery and develop standard norms for kabaddi players aged 18-20 years. Following extensive discussions and critical analysis, 20 test items were initially constructed. A pilot study was conducted with 115 kabaddi players, and seven test items were finalized based on expert consultation, establishing their validity, reliability, and objectivity. The selected skills included Side Target Kick, Reach Ability Hand Touch, Rope Climbing, Ankle Hold, On the Spot Bonus, Sudden Toe Touch, and Leg Thrust Reach Ability. A true randomized group design was employed, and the seven skill test items significantly correlated were subjected to factor analysis. The analysis yielded three factors comprising six test items: Attacking Body Skill Ability (Side Target Kick, Reach Ability Hand Touch), Leg Playing Ability (Ankle Hold, On the Spot Bonus), and Reaching Leg Ability (Sudden Toe Touch, Leg Thrust Reach Ability). These factors were believed to significantly contribute to the promotion of the game.

Norms were developed using percentiles and a 6-sigma scale. Individual performance on the skill tests was converted into a composite score, with a grading scale established based on the 6-sigma scale: A (Excellent), B (Good), C (Average), D (Satisfactory), and E (Poor). The study concluded that there was an interrelationship between the selected test items, and the factor analysis yielded three key factors. Six test items with high loading were selected to constitute the 'Battery of Kabaddi Skill Tests' for the 18-20 age group. The overall playing ability of players was interpreted using the grading scale developed from the percentiles norm.

John, L C (2016) conducted a study, this study aimed to develop and evaluate a battery of soccer skill tests for varsity soccer players aged 17-19 years. The subjects were 250 varsity soccer players from 15 colleges in Tamilnadu. Initially, 32 test items were constructed, with a trial run involving 20 soccer players from Bishop Heber College. After expert consultation and critical analysis, the test items were reduced to twelve, covering key skills such as passing, dribbling, shooting, heading, trapping, chipping, and throw-ins. The data collection took place in August, just before inter-collegiate tournaments, and involved administering the test items over consecutive days at the respective colleges. The validity of the test items was established based on expert recommendations and face validity. Reliability was confirmed through test-retest scores, with heading for distance showing the highest correlation (0.982) and shooting from 25 meters the lowest (0.589).

Factor analysis using Principal Component Analysis and the Varimax method extracted two significant factors from the twelve test items. These factors were named 'Playing ability by body' and 'Ball playing ability,' with five test items emerging as significant: heading for distance, throw-in for distance, passing with the outside of the foot, zigzag dribbling, and chest trapping.

A norm was developed for the five selected test items, converting raw scores into norm scores and creating a composite score for each player. These scores were then interpreted using a grading scale based on the 6-Sigma scale, with grades ranging from A (Excellent) to E (Poor).

Jesuraj A (2018) conducted a study, the purpose of this study was to construct a skill test battery and develop standard norms for women hockey players in Tamil Nadu aged 14 to 16 years. A total of 330 school-level female hockey players, who had played for at least two years and represented their school teams, were randomly selected. The researcher, a hockey coach, identified sixteen hockey skills as independent variables: Power Dribble, Speed Dribble, Pace Dribble, Zig-Zag Dribble, Direction Dribble, Long Pass, Short Pass, Speed Pass, Overhead Pass, Angle Shooting, Straight Shooting, Speed Shooting, Speed Right Dodge, Speed Left Dodge, Accuracy Jabbing, and Speed Jabbing. Using a randomized group design,

the collected data were subjected to statistical analyses, including Pearson's Product Moment Correlation to determine inter-relationships among the skills, and factor analysis through Principal Component Analysis and varimax rotation to identify significant factors. Three factors were retained, each with variables loading above 1.00 and accounting for more than 10% of variance. The final skill test battery comprised test items with the highest loadings.

Norms were developed using percentiles and a 6-sigma scale, converting individual skill performances into composite scores. A grading scale, based on the 6-sigma scale, was created to interpret the players' abilities, categorizing them as Outstanding (A), Very Good (B), Average (C), Below Average (D), and Poor (E).

Bahadur Singh (2015) conducted a study, the study aimed to construct norms for a specific physical fitness and skill test battery for university-level kabaddi players. Data were collected from 180 male players aged 18-25 years from three universities: Punjabi University, Patiala (n=60), Panjab University, Chandigarh (n=60), and Guru Nanak Dev University, Amritsar (n=60). Physical fitness tests included Muscular Strength, Muscular Power, Muscular Endurance, Speed, Agility, Jumping Ability, Throwing Ability, Flexibility, and Balance. Skill tests included Hand Touch, Toe Touch, and Back Kick. Statistical analysis, including Percentile Scale, was used to develop norms and classify scores into five grades: very good, good, average, poor, and very poor. Conclusions drawn from the study include specific normative values for each test across the three universities. For instance, in Muscular Strength, scores below 41.023 are considered very poor, while scores above 55.743 are very good for Punjabi University players. Similarly, for Muscular Power, scores below 40.847 are very poor, and scores above 49.487 are very good for the same group. Comparable norms were established for Panjab University and Guru Nanak Dev University players across all physical fitness and skill test items.

The study provides comprehensive normative data, allowing for a standardized assessment of kabaddi players' physical fitness and skills, facilitating targeted training and performance evaluation. These norms can be used by coaches and trainers to identify strengths and weaknesses, tailor training programs, and enhance overall performance in kabaddi players.

Seshaiah, Chitumadugula (2015) conducted a study, the study aimed to construct a new skill test battery and develop standard norms for Kho-Kho players. Six hundred school boys aged 13-15 years from Guntur, Krishna, and West Godavari districts of Andhra Pradesh, India, who had at least three years of Kho-Kho experience, were selected as subjects. The skills to be tested were chosen after extensive consultation with experts, resulting in eight test items: combination of chains, 1-4-5-6 run, zig-zag run, 3-3-2 run, giving Kho (pole to pole), and pole turn.

A pilot study was conducted to validate the research procedure, leading to the selection of these eight test items. The data obtained were subjected to descriptive analysis and intra-class correlation to assess the relationship between the test items. Factor analysis using Principal Component Analysis and Varimax Rotation Method was employed to refine the test battery, identifying two key factors: 'chain running ability' and 'playing ability at pole.' The six test items with the highest loadings were finalized for the skill test battery. Norms were developed using percentiles and a 6-sigma scale to interpret the playing ability of the players. A grading scale was created to classify players' overall performance into categories: Excellent (A), Good (B), Average (C), Satisfactory (D), and Poor (E). The study concluded that there was a significant inter-relationship between the selected test items, and the two main factors adequately represented the essential skills for Kho-Kho. The final skill test battery and the grading scale provided a comprehensive tool to assess and interpret the playing ability of Kho-Kho players in the specified age group.

Monika (2014) conducted a study, the study aimed to construct and standardize a specific fitness test battery for school girls' hockey players, focusing on motor fitness. Conducted in two phases, the research initially involved a pilot study with 30 girls aged 13-15 from Haryana, followed by a larger sample of 180 players. The reliability of 35 test items was assessed, with 19 selected based on expert consultation and face validity. Using principal component analysis, seven key motor fitness variables were identified: Agility, Speed, Flexibility, Coordination, Strength, Power, and Endurance. Specific tests were selected for each variable based on the highest factor loadings.

In the second phase, ANOVA and t-tests were applied to standardize the test battery. Significant relationships were found between motor fitness components and factors such as age, weight, and height. Comparison validity was established by contrasting successful players (selected for National tournaments) with unsuccessful ones, revealing significant differences in fitness test scores.

The findings indicated that the constructed test battery reliably predicts the specific fitness of hockey players, showing a strong relationship with hockey playing ability. The seven tests—40 Meter Run, Push-Up, 800 Meter Run, Agility Test-I, Bend Twist Touch, Vertical Jump, and Alternative Hand Wall Toss—proved to be reliable, objective, and valid, meeting scientific authenticity criteria. The study concludes that the developed fitness tests can effectively assess and enhance the motor fitness of school girls' hockey players.

Landge,Suresh Mahadeo (2016) conducted a study, the study aimed to establish uniform selection norms for the Solapur University volleyball girls' team by assessing 500 students from affiliated colleges. Data were collected on physical variables (speed, power, agility, abdominal strength, endurance) and performance variables (service, overhead pass, underarm pass, blocking, smashing). Mean and standard deviation values were computed to construct norms for each variable. The study highlights the significance of specific physical and performance attributes required in volleyball, emphasizing that different positions demand different skills and strengths. The selection criteria were developed through established scientific methods and factor analysis, ensuring the retention of essential physical fitness and volleyball skills. The study concluded that the developed norms are reliable and valid for assessing volleyball players' performance, aiding in the selection of talented players for Solapur University's team.

Key findings include the significant relationship between physical fitness, volleyball skills, and playing status, with the selection criteria effectively discriminating talented players for inter-university competitions. The study also found no relationship between constructed skill tests and playing status, noting that evaluation is based more on scores than performance. The results emphasize the importance of physical and skill-based assessments in selecting a standard volleyball team.

Ajaikumar G I (2013) conducted a study, the study aimed to construct and standardize a specific skills test battery for college male basketball players in Kerala, targeting 300 participants aged 18-25 who competed in inter-collegiate events. The primary objective was to develop norms for assessing and predicting basketball performance through a comprehensive test battery. Preliminary test items were identified and refined to include fifteen test items across four fundamental skills: dribbling, shooting, agility, and passing. Reliability was assessed using two-way intra-class correlation, with tests showing 'R' values above 0.90 considered highly reliable. Validity was determined through factor analysis, and objectivity was established via one-way intra-class correlation. The highly reliable tests included Figure of Eight Dribble Test, Forward Backward and Lateral Shuttle Dribble Test, Zig Zag Dribble Test, Dribble Shot Test, Jump Shot Test, Varied Angle Shot Test, Full Court Lay Up Shot Test, Forward and Backward Shuttle Run Test, Forward and Backward Half Court Shuttle Test, and Chest Pass Test. Tests with lower reliability ('R' values below 0.90) were excluded from the Final Test Battery (FTB). Factor analysis identified relevant factors for validity, with specific tests grouped under four factors. Hull scale statistical techniques were used to construct norms for the validated tests.

Conclusions highlight the high reliability, validity, and objectivity of the developed tests, which include Figure of Eight Dribble Test, Zig Zag Dribble Test, Dribble Shot Test, Varied Angle Shot Test, Forward and Backward Half Court Shuttle Test, Forward Backward and Lateral Shuttle Dribble Test, Forward and Backward Shuttle Run Test, and Chest Pass Test. These tests form a robust Final Test Battery (FTB) for assessing college male basketball players.

Mantri Deepak Laxman (2022) conducted a study, the researcher intends to develop a test for measuring catching skill. newlineThe study titled Development of Short-Catching Skill Test for Under 19 Cricket Players of Maharashtra study was to develop Shot-Catching Skill test for Under-19 Maharashtra. Population of the test was from different clubs, academies and gymkhanas of Maharashtra and players were selected by systematic sampling technique for the sample of the study. The construct was determined initially, followed by the procedure of test construction.

The descriptive method was used as a method of investigation. The pilot study was conducted on 30 players. Procedure was modified based on observation of pilot study. The improved test was conducted on 150 male cricket players for the Validity, Reliability and Objectivity of the test. Later on, 1000 male cricket players were selected and norms were developed. This Skill Test was constructed to measure the Short-Catching Skill at five different stages. After the test was conducted the validity, reliability and objectivity was calculated and was found to be 0.959(**), 0.970(**) and 1.000(**), respectively at a significance level of 0.01 level of the skill test. It was concluded that the Reliability and Objectivity was valid at significant level. Percentiles norms were developed and the players were evaluated with the help of norms. Hence the test developed stands to be a valid measure for measurement of short-catching skill of players of under 19 years of Maharashtra. newlineKey words: Cricket Player, Catching Skill test.

Basanagouda Laxmeshwar, S (2019) conducted a study, this study aimed to develop a valid, reliable, and objective Kabaddi skills-test battery for high school boys aged 14-16. Conducted in three phases, the research first identified twenty Kabaddi skills, designed tests for them, and administered these to 28 subjects, with performance rated by seven experts. High correlations confirmed the tests' validity, reliability, and objectivity. In the second phase, the twenty validated tests were administered to 100 boys. Principal Component Analysis reduced the number of tests to five key skills representing hand movement efficiency, leg movement efficiency, arm and leg coordination, eye-foot coordination, and shoulder and arm strength. The final five skill tests selected were Ankle Hold, Toe Touch, Thigh Hold, Hopping Hand Touch, and Waist Hold. In the third phase, these five tests were administered to 4008 subjects statewide. Data showed normal distribution, and T-scores and Percentile scores were computed. Validation against expert ratings showed high correlation coefficients, confirming the battery's predictive ability.

In conclusion, the developed skill tests are scientifically valid, reliable, and feasible for educational use, effectively measuring Kabaddi playing ability in high school boys. Factor analysis reduced twenty skills to five key components, demonstrating high correlation with expert-assessed game performance. The developed test battery effectively measures Kabaddi skills for the targeted age group.

Saravanan, B (2018) conducted a study, this research aimed to construct a battery of objective skill tests to assess the Kho-Kho playing ability of school boys aged 13 to 17. The study involved 30 players from Thirucenkode for reliability testing, 120 players from Pattukkottai for establishing criterion and construct validity, and 480 players for constructing norms and objectivity. The research was conducted in three phases. In Phase 1, six distinct skill tests were constructed after consulting experts and reviewing literature: Chain Kho, Zigzag Run, Running Around Each Sitting Square, Running Around Alternate Sitting Square, Shuttle Run, and Seven Minutes Run Around the Kho-Kho Pole. In Phase 2, reliability and validity were established through test-retest and inter-rater methods, showing high reliability and criterion-related validity for most tests. In Phase 3, objectivity was ensured by administering the tests to 480 players, developing percentile and Hull scale norms. Statistical analyses confirmed the reliability, validity, and objectivity of the tests. The intra-class correlation coefficients ranged from 0.895 to 0.999, while inter-rater correlations ranged from 0.971 to 0.997. Criterion-related validity was significant for four tests: Chain Kho, Running Around Alternate Square, Shuttle Run, and Seven Minutes Run. Objectivity was established by constructing norms that classified players into performance categories.

The study concludes that the constructed skill tests are reliable, valid, and objective, effectively measuring the Kho-Kho playing ability of school boys. These tests provide a standardized method for evaluating and classifying player skills, aiding coaches and educators in talent identification and performance assessment.

CHAPTER-III

METHODOLOGY

In this chapter, the procedures for conducting the study will be presented. This includes the selection of subjects, sampling methods, tools and equipment, data collection, subject orientation, selection of skills, tester competency, data reliability, test-retest administration, selection and descriptions of tests, and statistical analysis.

SELECTION OF SUBJECTS

In pursuit of the study's objectives, we will employ a rigorous sampling strategy. Specifically, we aim to select a representative sample of one hundred (100) Male Squash players whose ages fall within the range of 17 to 21 years. These individuals will be chosen through a purposive sampling technique from a diverse pool of talent hailing from various Colleges, Universities, and Academies situated across the entire country. This meticulous selection process ensures that our research encompasses a broad spectrum of squash players, spanning different educational institutions and training centres, thereby enhancing the generalizability and relevance of our findings to the wider population of young male squash enthusiasts within the nation.

SELECTION OF VARIABLES

The investigator conducted an extensive review of related literature to gather the necessary knowledge for constructing skill tests. Various journals, books, e-resources, unpublished theses, and dissertations were thoroughly studied before developing the test items. Existing test batteries were discussed with coaches and

experts. Scholars who had conducted similar studies in different sports disciplines were also contacted and consulted.

Every possible care was taken to select all the major skills to be tested. Any game is strongly influenced by its fundamental skills. Understanding that fundamental skills are the bedrock of a competitive game like squash, the opinions were collected and analyzed. The skills that emerged with higher weightage are listed below-

- Parallel drive from the backcourt (forehand and backhand both)
- Service from both the side
- Cross court drive (forehand and backhand both)
- Volleying
- Court movements

In order to execute skills with a high degree of consistency under the pressure of competition, players must first learn to perform the skills using correct methods. The following basic skills act as a framework upon which are built more complicated and advanced aspects of game.

RELIABILITY OF THE TEST

In this study, data reliability will be ensured by establishing tester competency and subject reliability. Tester competency will be evaluated by administering the test to selected participants twice and using Pearson's product-moment correlation method to assess reliability. Subject reliability will be confirmed by examining the correlation between test and retest scores. Subjects will receive a thorough orientation about the study's goals and test protocols to ensure their full cooperation.

DATA COLLECTION

To fulfill the purpose of the study, 100 squash players will be selected for test construction and 100 players will be selected for norms construction from various university colleges and academies. The data for the project will be collected by administering a test of playing ability.

STATISTICAL TECHNIQUE

- The mean and standard deviation of the newly constructed skill tests will be presented as descriptive statistics.
- To assess the reliability of the constructed test, the product moment correlation will be applied between the test and retest scores of each skill.
- Norms will be developed based on the percentile scale and 6 Sigma Scale.
- The level of significance will be set at 0.05.

REFERENCES

Afrcwzeh, M., Sohrabi, M., Taheri, H. R., Gcrgin, F., & Mallett, C. (2013). Effect ofPETTLEP imagery training on learning of new skills in novice volleyballplayers. Life Journal, 10(1), 231-238.

Afrcwzeh, W, Sohrabi, M,, Taheri, H. R., & Afroozeh, A. (2013). Optimal Timing ofMental Practice on Leaming the Volleyball Skill. Annals Of AppliedSport Science, (3), 28-29.

Ali, A. (2011), "Measuring soccer skill performance": Journal of Medicine & Science in Sports. 21: 170–183.

Anuar, N., Cumming, & Williams, S. E. (2016)- Effects Of applying PEITLEPmodel on vividness and ease of imaging movement Journal of Applied SportPsychology, 28(2), 185-198.

Arvitrn-Barmw, Weigand, D. A, Thomas, S, Hemmings, B.,& Walley, M.(2007). Elite and novice athletes' imagery use in 0Fn and closed sports. Journalof Applied Sport Psychology, i, 93104.

Ay, K.,Halaweh, & Al-Taieb, M. (2013). The effect of movement imagerytraining on leaming forearm in Education, 1342), 227-239. 118

Barber-Westin, S. D,, Hermeto, A. & Noyes, F. R. (2016). A six-weekneuromuscular and performance training program improves SFd, agility,dynamic balance, and core endurance in junior tennis players. AthleticEnhancement, 1—8.

Basanagouda Laxmeshwar and KK Amarnath(2018) ―Development of kabaddi offensive skills test for high school boys‖International Journal of Physiology, Nutrition and Physical Education ; 4(1): 608-610

Bassett, Gladys, Ruth Glassow, and Mabel Locke, "Studies in Testing Volleyball Skills," Research Quarterly. VIII (December, 1937) t 60.

Baumgamer, Ted A, and Jackson, Andrew S. Measurement forEvaluation in Physical Education and Exercise Science,

Begum, K. S. (2019). Construction of skill test and norms for squash players.

Buck, D. J., Hutchinson, J. C, Winter, C. R.,&Thompscm, B. A. (2016). The Effectsof Mental Imagery with Video-Modeling Self-Effucacy and MaximalSquat Ability. Sports, 4(2), I-IO.

Bujjibabu, & Johnson, p. (2012) Effects of Plyometric Training and Agilityand Quickness (SAQ) Training on Power of Male Handball Players,International Journal of Health. Physical Education and Comptter Science insports, A1),

Caeyenberghs, K-, Tsoupas, J_, Wilscm, p. & Smits-Engelsman, B. C. (2009) Motor imagery development in primary school children. DevelopmentalNeuropsychologv, 34(1), 103-121

Chalghaf, N-, Sbaa, S., Leveque, M., &Azaiez, F- (2013). Judo's Mental ImageryTraining and Technical Acquisitions unong High Institute Students. IOSRJournal of Research Method in Education, 1 i, 62-68.

Chandrakumar, N., & Ramesh, C. (2015). Effect of ladder drill and SAQ training onSFed and agility among sports club badminton players. International Journal OfApplied Research, /(12), 527-529.

Clarke, David .H and Harrison H. Clarke.(1984). “Research Process in Physical Education”. Englewood Cliffs, New Jersey: Prentice - Hall Inc

Clarke, David H. and Clarke, H. Harrison, "Research Process inPhysical Education", (Englewood N. J.: Prentice HallInc., 1984).

Clarke, M., Barnett, R., & Polman, R. (2016). Player movement patterns and game activities in the Australian Football League. Journal of Science and Medicine in Sport, 19(5), 443-447.

K.Kansal,d.(2012).A practical approach to test ,Measurement and evaluation.Newdelhi :sss.

Kamlesh, M. and Sangral, M.S. "Principles and History ofPhysical Education", (Ludhiana, Prakash Bros., 1981).

Mansoor ali khan and ajaykumar (2016) ―construction of Tennis skill test for junior national players‖. PhD thesis, Devi Ahilya University, Indore,2016.

Pushpendra Purashwani, (2010) “Construction of Norms for Skill Test Table Tennis Players”. International Journal of Table Tennis Sciences, No.6